“Non-Particle” Physics

Open Session

Fermilab Long Range Planning

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Scope of the Discussion

From: Marilyn Dixon
The title of this Open Session is written a few different ways. How do you want this written?

- **Non-(Part. Phys)**
- **Non-(Particle Physics)**
- **“Non-Particle Physics”**
- **"Non-Particle" Physics**

I guess if I have not heard from you in the next 15-20 minutes I will choose one and go with it.

I chose **“Non-Particle” Physics** (from Marilyn Dixon)

We confined our discussion to topics in physics and technologies that were closely related to Elementary Particle Physics

Core Competencies

- Development, construction, and operation of particle accelerators and beams.
- Development, construction, and operation of experimental detectors to learn about elementary particles and the forces that they experience.
- Computing and analysis techniques required to analyze the data generated by the accelerator and its experiments to learn something new about our physical universe.
- Scientific brainpower and associated tools to interpret the results and help plan new efforts.

Not exhaustive

(Almost) Single Mission

- In carrying out its mission as a “single purpose” laboratory. Fermilab has developed a wide range of talents and skills that are applicable elsewhere in science and technology
- Even with our strong focus on our core mission, we have always invested some effort in other activities
  - **The most notable case in point is our neutron therapy facility and also our work to establish the proton radiation facility at Loma Linda**
  - **Strong involvement in education outreach, e.g. QuarkNet and SciTech.**

The Question

- As we consider Fermilab's future, we must ask "What is the appropriate role/level for these "non-particle" physics and technology activities ?"

Note that none of us embraced the idea of trying to transform Fermilab into a multi-disciplinary lab, even if that were possible. We do want to consider whether these activities could, in fact enhance our ability to carry out our core program in some, perhaps indirect, but nevertheless real way.

Upside

- Provide a more diverse portfolio of projects that might permit us to attract innovative scientists, including those with multidisciplinary outlooks. This would bring us into closer contact with other communities of scientists and might introduce us to new ideas and new ways of attacking some of our problems.
- Permit us to contribute to the solution of problems that are of more immediate interest to society than ones we are working on in our “pure” research. This might help us convince the public that support for our work brings immediate benefits as well as the long term benefits that we claim derives from fundamental research.

More Upside

- In an era of a few, large projects, with possibly large gaps between projects, a variety of smaller projects might provide good opportunities to keep certain areas alive and well, to provide excellent platforms for training and education purposes.
  - **Small projects allow shorter iteration cycles, can be somewhat less "risk averse" since the consequence of a temporary setback or failure has far less impact**
  - **Many of today's leaders learned on such smaller scale projects**
- Help reduce HEP's isolation from other parts of the academic and R&D community

Downside

- The downside of such activity is that it can divert effort and resources from our core mission.

But, we could also get funding for these projects and could even do projects that would bring in additional resources.

Examples

- Given the 20 year time frame of this review, we can only give some general examples of the kind of work that might be undertaken
- We have identified the following project areas for initial consideration but there are obviously many others.
  - **Computational Physics and Computer Science**
  - **Uses of existing and/or future machines**
  - **Medical Physics/Therapy**
  - **Electronics technology and development**

We will provide examples in the following talks. Some of these are real in that we could be working on them now. Others are just indications of where we might look in the future.

Issues

1. **What are the criteria and decision mechanisms that can be used to determine what projects Fermilab should be involved in? This should include discussions of how closely the projects should conform to our existing set of skills and how closely they should relate to the core part of the program.**
2. **How can we evaluate the benefits and costs of a particular program to Fermilab, DOE?**
3. **What is an initial group of potential projects that can be pursued and can be used as test cases?**
4. **How does one establish an ongoing method for identifying new projects? and**
5. **How can we fit these projects into the overall program so that they can provide maximum benefit to the lab as a whole and how do we make that benefit known and acceptable to the HEP community?**

Communications

- We will put today's talks and links on our web page
- Please send EMAIL on your thoughts to FLRPC_non_particle@fnal.gov

This subcommittee is obviously comfortable with the idea that a portfolio of well-chosen "non-particle" physics projects could enrich and support the core program, would have positive value, and is worth encouraging.